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Indoor radon| A public policy study of incentives and barriers to government action

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INDOOR RADON: A PUBLIC POLICY STUDY OF INCENTIVES AND BARRIERS TO GOVERNMENT ACTION

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INTRODUCTION

In recent years, public awareness has been developing in relation to the public health risk from indoor air pollution. Most people spend about 90% of their time indoors and, as homes and offices have become more tightly sealed, pollutants become trapped with the result that toxic risk levels are intensified.

One of the more serious of these pollutants is radon gas, found in the natural environment, particularly near certain rock formations. Indoors, the gas breaks down into short-lived radionuclides called radon daughters which, when breathed over a period of time, increase the risk of lung cancer.

This paper begins with a case study about the discovery of above risk-level indoor radon in buildings in Butte, Montana and the efforts of the state of Montana to study and determine the extent of the problem. It goes on to describe the development of federal involvement which ranged from that of an investigative ally to an intrusive regulator. The paper explores some of the literature relating to the assumption of cancer risk from elevated indoor radon levels and the growing media attention to the potential of indoor air pollution as an individual and public health problem.

The final section broadens the public policy context by examining recent Congressional and Administration action

and inaction relating to indoor air pollution in general and radon in particular. Governmental options regarding this serious public heath threat are reviewed and projected within the current political climate.

Throughout the paper, we see the complexity of factors affecting incentives and barriers to governmental action. The central focus on public policy implications relating to the indoor radon problem in Butte covers seven years and is still without a definitive solution.

One of the major influences over this seven year period has been the widely divergent philosophy regarding the role of the federal government of the Carter and Reagan Administrations.

The Carter Administration took its role of protecting the public welfare seriously. The Reagan Administration perceives much of the federal government's previous strong role as unnecessary and undesirable. This Administration's "New Federalism" policy is that of persistent attempts to diminish and dismantle the size, structure and responsibilities of many federal functions that had been designated to be in the national interest.

The environmentally conscious Carter Administration sought and achieved quick action to protect the public health from environmental hazards. The role of government as an intervenor and that of a positive force for the public good was acceptable. This political philosophy underlies the

decision making processes in the earlier stages of the case study. When early data indicated a public health risk, the Department of Housing and Urban Development acted expeditiously with a non-traditional decision making process. Career employees and high-level political appointees were free to use the means to justify the end if the decision was in the public interest.

In contrast, under the current Administration, official barriers at the highest levels have substantially slowed down, but not totally blocked, agency activity in research and in developing solutions for indoor air pollution, particularly radon. The skillful, committed bureaucrat, who wants to make some progress in delivering solutions to the problem, may continue to achieve some results, but more with counterparts, and through the circumspect cultivation and development of Congressional action and media awareness than officially through Agency and Administration policy.

Meanwhile, Congressional attention to the issue is developing, but countervailing pressures will probably deter any major decisions that require funding in the near future. In the current climate of deep immersion and preoccupation with budget battles, just maintaining many vital programs and protecting them from extermination is considered progress.

BUTTE, AMERICA AND RADON

Butte, America: "The biggest mining camp in the world! "A mile high and a mile deep!" "The richest hill on earth!"[1] "Under the city twisted 2,700 miles of tunnels, and in their dim hot depths thousands of men worked and fought and died."[2]

Today, the mines are shut down and the town is in chronic depression. Forty years ago there were many cripples and frequent deaths. The Anaconda Company, which owned and ran the mines, and the unions, tried to elevate safety standards. But rock dust still "filled the miners' lungs and suphuric acid dripped from the walls of drifts, burning their clothing and flesh." The city's file of death certificates provided the tragic coda for the dramatic song of Butte: "Occupation, miner; cause of death, silicosis; was deceased's occupation responsible? Yes."[3]

In the early twenties, Federal Bureau of Mines officials asked Butte workers to check in for silicosis tests; forty-two percent of the 1,018 who volunteered to be examined had silicosis--"miner's con." Health and safety improvements later brought the "wet drill" and vastly better ventilation. The Company claimed that silicosis was virtually non-existent. Yet men continued to die of many pulmonary disorders, including silicosis, and Silver Bow County, populated mostly by the citizens of Butte, had ten

percent of the state's population and twenty-five percent of the tuberculosis deaths.[4]

Butte began in 1864 as a gold mining camp. During the past 100 years, more than 200 mines have operated in the Butte area. "These mines have honeycombed the Butte hill with shafts and tunnels and have littered the surface with mine wastes. Subsidence resulting from underground mining is an ongoing phenomenon as the hill area continues to settle and shift."[5]

In 1955, mining operations shifted from underground to open pit mining as the Anaconda Company began stripping and burrowing into the Berkeley Pit. By 1975, the company had abandoned underground mining. In the late 1970's, Atlantic Richfield (ARCO) acquired the Anaconda Company and continued Berkeley Pit operations until July, 1982. In early 1983, ARCO announced that Butte mining operations would terminate on July 1, 1983. It was cheaper to import copper from abroad.[6]

Geological Underpinnings

Butte's geology underpins its long, rich, and sometimes dangerous mining history. Butte lies in the Boulder Batholith, a mass of granitic rock. As it was created, the crust was subject to outside pressures. Stress fields solidified during the cooling causing faults and fissures, or breaks in the rocks. Within these faults flowed many hot liquids which later became mineral deposits.[7]

The Butte mineral deposit is ranked as world class. From 1880 to 1964, enough ore was mined to produce more than 16 billion pounds of copper, more than 4 billion pounds of zinc, 3 billion pounds of maganese, 699 million ounces of silver and 2-1/2 million ounces of gold.[8]

In the past seven years, the tough, stoic citizens of Butte have learned of another potentially deadly hazard invading their lives and their lungs. This time, radon gas, invisible and odorless, was discovered drifting into the privacy of the miners' homes.

Radon is produced by the decay of uranium 238, a trace element in the earth's crust. Outdoors, it disperses into the air. Indoors, it decays into other radioactive elements called daughters, that bind to dust particulates. When inhaled into the lungs, the radon daughters can cause cancer. Researchers have recently estimated that 2,000 to 20,000 cases of lung cancer in the U.S. each year may be caused solely by indoor radon pollution.[9]

Radon Discovered Accidentally

The presence of radioactivity was discovered accidentally in 1977 by Larry Lloyd, chief of the Occupational Health Bureau of the Montana Department of Health and Environmental Sciences. As he was driving into Butte to investigate the health implications of phosphate slags at the Stauffer Chemical Company, Lloyd had his scintillator, a radiation measuring device, sitting on the

seat beside him. Approaching one area of Butte, the scintillator "went off the wall" and as he neared an outcropping, it "went nuts."[10]

The Montana Department of Health and Environmental Sciences (DHES) then initiated an investigation into the use of phosphate slag in the Butte and Anaconda areas. Phosphate slag is a byproduct of an elemental phosphorus smelter about seven miles west of Butte. It had been used extensively throughout the city in construction. It was found not only as a ballast in railroad beds and in road and highway, parking lot and playground construction, but used in concrete blocks and pre-stressed concrete beams and slabs in building materials for homes and schools.[11]

The use of phosphate slag was of concern because it had a high level of natural radioactivity, particularly radium-226. As the investigation proceeded, DHES discovered elevated radon and radon progency concentrations in buildings in Butte. The cause was unknown.[12]

EPA Becomes Involved

In November, 1977, Montana notified the Environmental Protection Agency (EPA) in Denver and requested assistance. The following April, in 1978, EPA sent a van equipped with a large collimated gamma scintillation detector. Staff from DHES and the Office of Radiation Programs of EPA conducted a gamma scanning survey with the van and identified about 750 locations having elevated levels of radioactivity. By

September, this information was further refined with indoor surveys and many homes with high radon progency concentrations were identified.[13]

The State of Montana continued its investigation in what was thought to be a responsible and prudent manner. Governor Thomas L. Judge found some funds to begin a program "to determine the magnitude of the radiation problem, assess health risks and initiate necessary measures to protect the health and welfare of the people." The 1979 Montana Legislature appropriated $100,000 to DHES for a 2-year study to determine what was responsible for the elevated radon levels.[14]

In April, 1979, informal discussions concerning the early data of the initial 1978 survey were going on in the Denver federal regional offices between EPA staff and the environmental staff of the Department of Housing and Urban Development (HUD). Montana's request for EPA assistance in what was thought to be a methodical state effort to identify and assess the problem was stirring up high concern in Denver. Gerald Hannon, Deputy Director to the Regional Administrator of HUD was becoming particularly alarmed about the findings.[15]

Back in Butte, an editorial in the June 11 edition of the Montana Standard stated that: "Checks of homes built with, and without, slag building materials, however, produced elevated readings in some of the non-slag homes, too. State

health technicians speculate that natural radiation sources are responsible for some of the readings, but they stress that more checking is needed before they can draw firm conclusions.

Increasing numbers of Butte residents have begun to refuse the team permission to monitor their homes lately, especially since CBS-TV televised a piece on the local situation. When the study is complete and the data carefully examined, the health people will be able to tell us what it all means and what remedial action might be taken. The best thing now is to cooperate with the study and not get overly excited about these early radiation findings. About the only conclusion that can be drawn so far from the state health team's study of Butte's elevated radiation levels is that one shouldn't jump to conclusions."[16]

Three days later, on June 14, the radioactive perils of Butte, Montana, hit the New York Times. The lead paragraph theorized that "Butte sits on top of a honeycomb of old copper mines, and the mines are apparently acting as collectors of radon gas and its cancer-causing offspring, known as radon daughters." But Paul Smith and other officials of the EPA "emphasized that the radon-collecting tunnels theory was just that." It just seemed "the most logical explanation for the scattered pattern of 'hot' houses in Butte." Larry Lloyd, who was systematically proceeding

with his research, "was considerably put off by a CBS News report on the situation that he considered alarmist."[17]

Lung Cancer Threat

By this time, Lloyd had studied about 300 houses in Butte and found that those in the Northwest section, known as on the "Hill", under which lay most of the underground mines, had the highest levels of radiation. For the first time, on June 14, the cancer threat was revealed in stories in both the New York Times and the Montana Standard. EPA's Smith said that "studies in Florida have shown that with normal background radiation levels, it can be expected there will be 3,000 cancer deaths per 100,000 population over a lifetime. But, when background radiation levels reach the EPA standard of 0.02, working levels (WL), the number of cancer deaths can be expected to jump by about 2,000 to 5,000."[18] And the New York Times said that Butte's lung cancer rate is 54.3 deaths per 100,000 population. The state rate is 30.1 and the national rate is 35.3.[19]

On July 26, 1979, Governor Thomas L. Judge wrote to Douglas Costle, Administrator of the U.S. Environmental Protection Agency, in support of a grant to the State of Montana for $71,075 to add one full-time employee to assist with the study for fiscal years 1980 and 1981.[20]

Judge stated that: "When the budget was established, it was believed that the increased radioactivity levels found in several Butte homes were due to the widespread use of

phosphate slag in building and roadway construction. Since that time, the following has been found: (1) Elevated levels of radon daughter concentrations in Butte area homes are much more widespread than previously imagined; (2) the use of the phosphate slag is not responsible for the increased radioactivity in the affected homes; and (3) ambient radon and radon daughter concentrations are elevated during some meteorological conditions.

Because the scope of the Butte environment radiation study has expanded to such a large extent, the additional employee is necessary to bring the study to a timely and satisfactory conclusion," Judge concluded.[21]

HUD Moves on Butte

Meanwhile, in Denver, a HUD Task Force was developing procedures for Radon Progency Screening which involved discussions with EPA and DHES. Included in the preparations was a planned award of a $65,000 Community Development Block Grant to Montana for technical assistance.[22]

On August 15, Hannon, the spearhead of HUD's involvement in Butte, memoed Alan Kappler, a member of the HUD Environmental Task Force in Washington, D.C. This high-level Task Force was chaired by the Under Secretary, then Jay Janis, second in command to HUD's Secretary Patricia Harris. Other members included the Assistant Secretaries and Regional Administrators.[23]

The memo described the problem and HUD's funding and insurance programs for fiscal year 1979. Attachments set forth the testing system to be used by the state for measuring the amount of radon daughters inside homes. The $65,000 technical assistance grant was being negotiated with the state and all HUD contracts were to be amended. The memo concluded that "Although the above process and procedures are out of pattern with the Department's standard operating procedures, they are essential due to the imminent health hazard discovered in Butte and Anaconda."[24]

What was "out of pattern?" What was unusual was the decision that was made and the manner in which it was done. HUD has a mandate to insure that all HUD-assisted projects are located in a safe and healthful environment. Hannon, having access to preliminary data from EPA, pressed for a decision that the regional administrator, Betty Miller, recommend to the HUD Environmental Task Force that testing be required for indoor radon for all HUD-assisted projects or loans in Butte. The Task Force approved and implementation proceeded quickly, all within just a few weeks.[25]

This was during the Carter Administration and the political climate of the times was one of high environmental concern and protection. The Carter Administration perceived its role as getting involved, setting policy and intervening if necessary to protect the best interests of citizens. Because of the political mandate and environmental

"urgencies," this Task Force did not follow the normal decision-making process of the agency which was a more thorough consideration and analysis of data and options through several staff levels. After Pat Harris left the Secretary's position, the Task Force was phased out.[26]

This model of decision making was expeditious, but was it fair and equitable? Was it based on sufficient data, analysis and consultation?

There were early indications that there was a significant problem in some houses. The high incidence of accelerated radon risk levels in Butte, accidentally discovered, was unique at the time and decision makers accordingly thought the situation merited special protection for its citizens, even before a thorough study was completed. Radon is everywhere in the natural environment. Didn't other areas also have high risk levels? Didn't the health and welfare of the rest of the country matter? Aren't all citizens of the United States entitled to equal protection under the law? Yes, but locating, assessing and remediating toxic risk problems is a long, complicated and arduous process. Even more difficult is ascertaining private and governmental responsibility.

John Giedt, with EPA in Denver, said that HUD, as a "prudent administrator" needed to make this decision just because they knew "that Butte might have an accelerated incidence of radon. As an insurer, if a home had a high

radon reading, HUD might be left holding unsafe property if not protected by the testing requirement." But now, Giedt agrees that "it's so unfair to single out Butte and not be able to give them a solution."[27] John Endres, who, in 1979, was special assistant to HUD's Regional Administrator in Denver, now says, that "at the time it was a good decision. It was made at a time which predated setting up procedures. But now, Butte is out there all by itself."[28]

With no local input and very incomplete information as to the specifics or extent of the potential radiation problem, HUD on September 13, 1979, precipitiously announced a clamp on "all current HUD funds for public housing and future private housing insurance loans by FHA unless homes are tested for radiation levels." John Endres announced the ruling. "It's HUD's policy to protect the individual home buyer's health and welfare when using HUD money for Federal Housing Administration loans or living in a public housing project funded by HUD," Endres said. "If a home or housing unit is above 0.02 working levels of radiation, the loan will be denied. HUD will provide the state health department with a $65,000 grant to hire two persons to conduct tests for public housing. But sellers seeking FHA loans for private sale must pay $52 to cover the costs of the tests."[29]

Butte Reacts in Shock and Dismay

The reaction in Butte to the sudden announcement was basically that of shock and dismay. Gladys Barry, Anaconda

Housing Authority Director, said the ruling came "like a bolt out of the blue." Chief Executive Don Peoples said, "What bothers me is that the EPA has no conclusive evidence there's a health hazard here. We're caught in a squeeze between HUD and EPA."[30]

Betty Kissock of Kissock Realty reacted, "It's a typical bureaucracy. I don't see why the same standards couldn't be set up across the country instead of just Butte and Anaconda." Kissock went on to say "People are really angry. I think we'd better get to the bottom of the charges and find out how much radiation is here before HUD can issue statements like that." Louise Wulf of Wulf Realty said it even more strongly. "I think it's an awful kick. It's cutting our throats."[31]

Perhaps the most cynical response of all came from State Representative Bob Pavlovich and Pat Kinney, Executive Vice President of the Chamber of Commerce when they "agreed over beers at Mr. Pavlovich's Met Tavern that the basic problem was overexcited environmentalists. It was the consensus among the tavern patrons that "environmentalists were a greater hazard than radiation."[32]

The congressional delegation, Senators Baucus, Melcher and Representative Williams wrote asking for immediate testing of the area by EPA "because there does not appear to have been adequate public input prior to the HUD decision and because the decision on HUD loans can affect the availability

of any housing money." Melcher told the Montana Standard, "My feeling is there is probably a lot of the area that does not have the radon gas. I think they should identify the specific houses they are claiming to have high radiation levels and provide rehabilitation for those homes."[33]

EPA Chief Costle replied to Governor Judge on September 26, 1979, reviewing the cooperative efforts of the past two years between EPA and DHES. He suggested exploring further assistance to Montana with the requested funding in the form of a contractual agreement between DHES and EPA's Office of Radiation Programs. Under such an arrangement, EPA would receive a report of the radiological data.[34] An extensive 3-year study ensued which was released in July, 1983. The original grant was to be for $81,804, but the final estimated cost was close to a million dollars.[35]

Inspection procedures officially began on September 17, 1979. The Montana Department of Health and Environmental Sciences, in conjunction with the EPA, developed and furnished to HUD a radiation survey protocol which defined the criteria and methodology of the tests. Two criteria were set. One was the 0.02 weighted indoor working level "that the Administrator of EPA had found as the acceptable level in terms of the increasing long term risk of lung cancer in the exposed population." Also, if a weighted indoor working level measurement exceeded 0.015 WL, an additional set of

measurements was to be made on another day for verification.[36]

Betty Miller, HUD Regional Administrator, in a speech to the Montana Realtors on October 5, defended HUD's action. She said that as a result of discussions with EPA, they became convinced that HUD "could not simply ignore the problem." She also recognized the uncertainties of having no national standard for exposure limits, no clear understanding of the source or sources of the radon gas and the lack of knowledge of the location and number of homes with excessive levels of radiation. But, she said that if HUD were to take no action, they "might be placing a family in a potentially hazardous situation when it had every right to expect that HUD would do everything possible to be sure that its home was both physically sound and healthful to live in."[37]

[1]Joseph Kinsey Howard, Montana High, Wide, and Handsome (Yale University Press, 1943), p. 85.

[2]Ibid, p.86.

[3]Ibid.

[4]Ibid, p. 87.

[5]Larry L. Lloyd, Evaluation of Radon Sources and Phosphate Slag in Butte, Montana (Occupational Health Bureau Montana Department of Health and Environmental Sciences, EPA Contract No. 68-01-6100) p. 7.

[6]Ibid.

[7]Ibid.

[8]Ibid.

[9]John Carey, Mary Hager, Patricia King, Seth Zuckerman, "Beware Sick-Building Syndrome,' The Deadliest Pollutants of All May be the Ones You Breathe at Home or at Work," Newsweek (January 7, 1985) p. 60.

[10]Larry Lloyd, Washington, D.C. telephone interview, Washington, D.C. to Helena, Montana, 14 January 1985.

[11]Larry Lloyd, Evaluation of Radon Sources and Phosphate Slag in Butte, Montana, p. 3, p.5.

[12]Ibid.

[13]Douglas M. Costle, Administrator of the United States Environmental Protection Agency to Thomas L. Judge, Governor of Montana, September 26, 1979.

[14]Larry Lloyd, Evaluation of Radon Sources and Phosphate Slag in Butte, Montana, p. 5.

[15]Documents Relating to Procedures for Radiation Problem in Region VIII Butte and Anaconda, Montana. (Photocopied.)

[16]"Radiation Study Far From Complete," Montana Standard, 11 June 1979.

[17]"Health Aides Fear Old Mines Under Butte, Montana, Hold Radioactive Peril," New York Times, 14 June 1979.

[18]"Federal Official Suspects Gas Trapped in Mine Tunnels," Montana Standard, 14 June, 1979.

[19]"Health Aides Fear Old Mines Under Butte, Montana, Hold Radioactive Peril," New York Times, 14 June 1979.

[20]Governor Thomas L. Judge to Douglas Costle, Administrator of the U.S. Environmental Protection Agency, 26 July 1979.

[21]Ibid.

[22]Documents Relating to Procedures for Radiation Problems in Region VIII Butte and Anaconda, Montana HUD.(Photocopied.)

[23]Ibid.

[24]Ibid.

[25]Pierre Brousseau, interview, Washington, D.C., 11 December 1984.

[26]Ibid.

[27]John Giedt, telephone interview, Washington, D.C. to Denver, Colorado, 15 January 1985.

[28]John Endres, telephone interview, Washington, D.C. to Denver, Colorado, 16 January, 1985.

[29]"Housing Funds Cut in Radiation Areas," Montana Standard, 13 September 1979.

[30]Ibid.

[31]"Anger Follows Housing-Fund Radiation Ruling," Montana Standard, 14 September 1979.

[32]"Health Aides Fear Old Mines Under Butte, Montana Hold Radioactive Peril," New York Times, 14 June 1979.

[33]"Anger Follows Housing-Fund Radiation Ruling," Montana Standard, 14 September 1979.

[34]Douglas Costle, Administrator of EPA, to Governor Thomas L. Judge, 26 September 1979.

[35]Larry Lloyd, telephone interview, Washington, D.C. to Helena, Montana, 14 January 1985.

[36]Documents Relating to Procedures for Radiation Problems in Region VII Butte and Anaconda, Montana.

[37]Ibid.

BUTTE RADON PATTERNS STUDIED

In October, EPA scheduled a two day helicopter flyover survey for taking air samples to identify areas of high radon levels. According to Lloyd, this project became a costly $100,000 failure. The flight did not have adequate equipment to detect radiation patterns and therefore the data couldn't be analyzed. "They flew too high and too fast. It was a disaster before they even got there." Lloyd said.[1]

During 1980, Lloyd went on with his EPA and Montana-funded study and the HUD-required testing. The study was redirected because it was not clear that slag was the source of radon. In fact, a number of structures were found to have higher radon progeny concentrations than buildings containing slag. Since Butte had extensive disturbances to its surface and subsurface geology because of the underground and surface mining, it was suspected that this, in conjunction with the subsidence and natural geologic fault zones, could be the causes of the high radon levels. Several thousand homes were to be investigated in the redirected study.[2]

Two main tasks were identified. The first was to measure radon progeny inside and outside buildings in order to try to pinpoint the source of elevated radon concentrations. The other task was to place about 200 alpha track detectors on a grid basis in the soil to determine radon soil gas concentrations.[3]

A "grab sample" testing process, which took less than ten minutes, was used in homes. The most severely impacted area was "The Hill," where occupants were contacted on a house-to-house basis and asked for permission to measure radon progeny concentrations. The news media gave the radiation study considerable publicity, and many homeowners became aware of potential health risks and asked that their homes be tested.[4]

Structures selected for testing were chosen because they contained phosphate slag building materials, were located in areas known to be elevated in indoor radon concentrations, were requested by individuals because of health concerns, or were required to be tested by HUD or FHA. Therefore, the structures selected became a biased sample and extrapolation of data for any city-wide average was not possible. The grab sample technique was an accurate measurement at the time of sampling, but could be in error as a standard for the structure because of seasonal and daily fluctuations. Long-term sampling was done in some selected buildings to estimate average concentrations for a year. This testing was carried out for about a week every three months.[5]

Many factors seemed to affect the variations found in radon concentrations. Such things as ventilation rates in the structure and radon soil gas concentrations in the soil next to the buildings were important. If a driveway, patio

or sidewalk kept the radon gas from normally escaping into the air, the gas would be more concentrated and instead be exhaled into the structure. The testing required that the building be closed for a certain length of time before the test, even though normal activity on a day to day basis would affect the gas levels. Open doors and windows, wind speed, traffic in and out of the building, heating systems, the air exchange rate and changes in the soil moisture and ground frost all impacted on concentration levels.[6]

Adding to the complexity of measuring any stable radon levels was the fact that the Butte area has severe atmospheric thermal inversions that trap pollutants, including radon. These levels seemed to be the highest at about 6 a.m. and the lowest about 6 p.m.[7]

As the study progressed, it was found that structures exceeding 0.02 WL were distributed throughout the city but, again, were mostly in the northwest section. Dramatic increases in levels seemed to occur in buildings built over mineralized veins or over fractures. It was believed that these fractures in the underlying geology act as conduits to bring radon to the earth's surface.[8]

Lloyd Reports to Legislature

Lloyd reported his findings to the Montana Legislature when it met for its biennial session in 1981. In a three-day series on Lloyd's report to the Legislature, the Montana Standard on February 10, 1981, quoted Lloyd as saying that

the Legislature's "conservative fiscal mood, combined with misconceptions about the Butte study, would make nearly impossible his quest for additional funding and staff to study radiation problems elsewhere in the state as well as to provide the final monitoring and remedial work for Butte."[9]

The report to the House Finance and Claims Subcommittee stated that the original intent of the study to determine the uses and risks of slag-related radiation and impose controls was no longer valid as the phosphate slag "exhales even less radon than native soils in the Butte area." The report also examined the difficulty of determining the cancer risk factor which is deduced by projecting the increase of lung cancer rates among uranium miners to the general population that has been exposed to radon. But it went on to say "Despite uncertainties in health effects at relatively low levels of exposure, it is prudently assumed that living in a home with elevated radon daughter levels increases an occupant's risk of lung cancer proportionate to the levels within the structure and the number of years of exposure."[10]

On February 12, 1981, the Montana Standard quoted Lloyd as telling the legislators that "Questions persist about how to correct the radon daughter levels in homes." Grab sample measurements in Butte homes tested through December 31, 1980 showed levels of 0.02 WL in 725 of 2,516 samples and more sophisticated measurements showed levels

greater than 0.02 WL in 81 homes. During severe thermal inversions, Butte's air showed levels above 0.02 which complicated the radon source question even further. Lloyd said that, in 1979, EPA recommended remedial action in all cases where the indoor radon level exceeded 0.02 WL.[11]

HUD came through with a $75,000 grant to draw up a remedial action plan which was to be contracted out. Lloyd asked the Legislature to increase his staff by two as he didn't "even have the personnel to monitor the contractor." Lloyd concluded that the Legislature had a "negative attitude toward further radon studies." He was right. The Legislature would appropriate no more money.[12]

Public Housing Mitigation

In March, it was announced that Silver Bow Homes, a public housing project in Butte, would receive a $470,000 grant for a "radon mitigation program that will serve as a prototype for all government housing in highly mineralized areas in the United States," according to project director Paul Quinn.[13] First phases to test remediation methods with radon monitors in a 13 unit "test building" began in June. By this time, 35 units were found to have elevated levels and occupants had been moved out.[14] Fifty-seven of the 225 apartments in the complex were finally found to have exceeded the 0.02 WL. The remediation work was actually completed in 1982 by sealing penetrations beneath the apartments and in the crawl spaces and spraying the undersides of the floors

with one and a half inches of polyurethane foam. A passive ventilation stack was also put in from the crawl space through the roof of each apartment. The remediation effort was successful as remeasurement of each of the 57 apartments found that all were by then below the 0.02 WL.[15]

Is Lung Cancer Threat Real?

Underlying this entire radon detection, analysis, regulation and remediation effort was, of course, the threat of the increased risk of lung cancer. In June of 1981, the Air Quality Bureau of DHES released its Montana Air Pollution Study (MAPS). This was a major $1.5 million four-year study of the effects of air pollution on human health in several of Montana's urban areas.[16]

The MAPS findings on lung cancer in Butte were far from conclusive. Of the twenty-eight Montana counties studied, Silver Bow had the fourth highest death rate of cancer of the respiratory system, 54.3 per 100,000 population as compared with the state rate of 30.1 and the national rate of 35.5. Silver Bow County also had death rates higher than the state average for almost all disease, age and sex categories. Of particular interest was that cancer mortality rates were very high for females of all ages as well as males. As men were more associated with the risks of a mining-smelting work environment, this implied that pollutants in the non-mining environment might be a cancer risk factor for females.[17]

Followup interviews were conducted with as many surviving relatives of lung cancer decedents as could be found from three counties, including Silver Bow. Questions were asked about the smoking habits of the decedents. It was found that a significantly larger number of smokers from Silver Bow County were found in the lung cancer group than in a control group that died from other causes. The conclusion was that the unusually heavy smoking was such an "overwhelming variable" that it could not be isolated in order to assess other variables such as air pollution--including radon. It had also been found that school children in Butte and Anaconda had decreased pulmonary function as ambient (outdoor) air pollution increased and that both communities had high levels of carcinogenic substances in ambient air."[18]

On August 14, 1981, the Montana Standard announced that DHES would test new passive measuring devices for EPA that could be placed in homes for a longer period of time with cheaper, faster, more accurate measuring results. By now, the EPA contract had been extended to $300,000 which, if added to the $600,000 total from HUD and $100,000 from the Montana Legislature, would amount to at least a million dollar radon daughter search and remediation effort thus far.[19]

Remediation Recommendations

Meanwhile, ARIX, a professional corporation of engineers, architects and planners, was completing its HUD contract on remediation recommendations with DHES. Its report, Planning and Design for a Radiation Reduction Demonstration Project, was released in January of 1981. It found that the majority of structures with elevated radon levels were, again, in the northwest section of Butte and that the degree of elevated radon progeny concentrations could be related to the area of exposed soil beneath the surface. There were three basic categories of existing structure types--full basement, crawl space, and basement/crawl space combinations. Twelve remedial action plans were presented based on previous projects in the United States and Canada. These included detailed techniques for sealing radon entry routes, subfloor ventilation of concrete slabs, crawl space ventilation and structure ventilation. To assure sound statistical evaluation for a demonstration project, it was recommended that each of the twelve designs be repeated 3 times for a total of 36 structures. The techniques developed were based on cost-effectiveness, the level of maintenance required, energy costs to the homeowner and performance.[20]

The demonstration program goal was to provide techniques which could be installed by an ordinary homeowner or a builder at a reasonable cost. Although some of the

plans ranged up to a cost of $3,000, this included labor. Materials for most of the projects averaged about $500-$600 and could be done by the average homeowner.[21]

Monitoring both costs and radiation levels closely at every stage of the demonstration project would also be essential to determine the most cost-effective means of reducing or preventing elevated radon daughter concentrations.[22]

By March, Larry Lloyd had submitted a written report. He found that ARIX had done a good job of assessing structure types in Butte which are prone to elevated radon daughter concentrations. Slab-on-grade construction types could not be investigated as this building technique is essentially unused in Butte. He also noted that it may not be possible to test remedial techniques in new construction as the depressed economy in Butte had brought the building of new homes to a standstill. Lloyd felt that homeowners would not be very likely to use techniques involving much structural ventilation because of the increased energy costs. He concluded that any "reputable architecture/engineering firm should be able to extrapolate the remedial design detail to site specific locations with little difficulty." Costs for the project, in 1982 dollars, were estimated to range from $145,117 for twelve structures to $271,317 for 36 structures.[23]

The second stage of the remediation project, the demonstration itself was to have been funded by HUD. But HUD did not follow through on trying to show homeowners how they might protect themselves from the radon risk, maintaining that funding for the second year grant was no longer available. The demonstration grant proposal was later submitted to EPA.[24]

HUD Pressed to Rescind

In 1983, events began pressing for some action. Lloyd's comprehensive study evaluating radon sources and phosphate slag in Butte was published in June. It concluded that ambient air, soils and surface geology all contributed to the indoor radon problem. As expected, homes built over major fractures or mineralized veins were the most severely affected and aplite, quartz monzonite and soils also contributed to higher rates. Ambient air was also thought to be a possibly significant source of indoor radon during certain atmospheric conditions.[25]

The HUD contract to DHES for radon testing for FHA financing and in public housing was running out on June 30. Butte-Silver Bow Chief Executive Don Peoples wrote to the Congressional delegation on March 18. He stated that "in my view, the real need for this radiation testing has never been justified. On June 30, 1983, the State Department of Health's contract with HUD will cease and we will no longer have a mechanism with which to comply with regulations. This

means there could be no more FHA loans made on previous loans nor could Public Housing Assistance programs continue. This situation could have disastrous effects on this community. If conveyance of homes through FHA is precluded, another crippling blow will be dealt. In our view there, there is absolutely no justification for continuation of the testing policy."[26]

Senator Melcher then wrote to HUD Secretary Samuel R. Pierce, Jr. restating the position of Don Peoples and asking that the Department "accelerate its review process and remove the requirement for radon testing."[27]

HUD did not reply. With the deadline approaching fast, staff from the offices of Senators Melcher and Baucus and Rep. Pat Williams called for a meeting with HUD officials. On June 28, Congressional staff met with Jim Christopulos, Senior Environmental Engineer, Steve Cooley of the Housing Division and Pierre Brosseau, Office of Field Coordination. Staff stated that it had been two months since letters had been written asking that the testing requirement be lifted as Butte had been unfairly singled out. Any health hazard had been blown out of proportion, they felt. The radon incident was the result of natural phenomenon which had been there for hundreds of years, and people had been living there for hundreds of years, they said.

Congressional staff asked for the criteria used to make the decision to require radon testing in Butte, the

criteria used to determine the health hazard, a listing of all other cities in the United States where HUD requires radon testing for FHA conveyance (the answer was none), a listing of all other communities in the United States that had similar radon levels and the reason that HUD didn't require testing there. It was strongly recommended that the test requirement for Butte be dropped or that it be imposed in other areas with high radon levels such as Maine, Utah and other mining areas.

Complex HUD Decisionmaking

HUD officials at the meeting advised Congressional staff that the final decision would be made at the Secretarial level, after first being signed off at all program levels.

The press reported again on June 24 that the local government would have to take over the tests July 1. The story quoted Senator Melcher's May 5 letter to Secretary Pierce and his statement that staffers from his office and from offices of Rep. Pat Williams and Senator Max Baucus would meet with "undersecretary level HUD people...at least we are going to get to talk to the level of people who can take action."[28]

And still, nothing happened. Congressional staff had done enough checking by now to learn that Butte was not a community unique in having elevated radon levels. In January of 1984, Senator Melcher wrote another letter to Secretary

Pierce. He said that the "Department seemed to be having a difficult time making a decision on his request to identify the health hazard of radon in Butte or not interfere with house sales." He said, "There is a clear and simple choice. Either stop unfairly singling out Butte for this radon testing requirement or apply it uniformly and equitably to every other community in the United States with similar radon levels and identify the health hazards." Melcher went on to cite other areas in the country with identified higher radon levels where HUD was not requiring the radon test. He said he felt the proper way to handle radon problems was through state and local efforts, with federal assistance, of identification and remediation for homes with elevated radon levels.[29]

In the over five years that HUD required radon testing for FHA loan approval in Butte, only two out of 425 homes tested have been above the 0.02 WL.[30] The City-County Health Officer, Bill Burke, who is responsible for the testing says it is valid and people don't try to sabotage findings by opening doors and windows.[31] However, Betty Kissock, a longtime, leading Butte realtor feels that the test is a "sham." She suspects that people do open their windows because they are under so much pressure and FHA financing is the only way they can sell a house. She vehemently continues to feel it is an imposition and terribly unfair, but says it does not generally impede sales since would-be buyers are

simply told it is a requirement and only one or two homes have tested above the risk level.[32]

Following the January, 1984, Melcher letter, staff checked with Pierre Brousseau in the Office of Field Coordination of HUD who had been handed the responsibility of developing a decision abstract on the issue for the Secretary. Preparing a response to the letters from the Montana Senators, Representatives, Governor and Butte-Silver Bow Chief Executive had become a complex process.

Normally, all mail from members of Congress is first routed to the Executive Secretariat office of the Secretary which assigns it to the appropriate division for response and monitors its progress. After staff have prepared a recommended response, every policy matter is reviewed by every Assistant Secretary that has an interest in the issue.[33] The Environmental Task Force that initiated the original radon testing decision had long since been dissolved. Therefore, it went back to the basic decision making process at the division level.

The letters were bounced around at the beginning. They first went to the Office of Single Family Housing and then to the Assistant Secretary for Housing. Housing said it was an environmental issue and sent it over to the Assistant Secretary for Community Planning and Development where it went down to the Office of Environment and Energy. All of the division heads reviewed the correspondence, but since it

was more of an issue than they had originally thought, neither division wanted to take action.[34]

Therefore, it became the responsibility of the Under Secretary to whom report all of the Assistant Secretaries. Also reporting to the Under Secretary is the Deputy Under Secretary for Field Coordination. Pierre Brousseau, in that office and responsible for Federal Region VIII, landed the job of reconciling the contradictory goals, missions and positions of the two divisions and the Office of General Counsel.[35]

The Environmental Office felt the testing must continue because an environmental hazard did exist. Housing wanted to drop the requirement as their main goal was housing production and financing.[36]

To try to resolve the differences, a lengthy negotiation process evolved. Brousseau sent the correspondence back down to Housing, Environment and the General Counsel asking their staff to state their positions. When these came back, he put them all together into a combined document and sent it back down again through all of the channels. It was obvious that there were many contradictions, but for the first time, all of the staff involved could see each other's positions on paper.[37]

The negotiation process continued with Brousseau making four revisions in which everyone involved could see each other's positions and make written comments.

Rewriting was based on comments from the previous document and negotiations. Brousseau also tried to accommodate the positions of each group and the environmental regulations.[38]

Finally in the spring of 1984, principal staff that had been involved sat down in a conference room for two days going over the final draft document paragraph by paragraph to get agreement on language. A final paper was hammered out as an abstract to the Secretary giving the background of the situation with an accompanying decision paper broken down into various points with a yes, no or comment space.[39]

Then the paper went back into the final clearance. Staff made the basic policy decisions and briefed officials who were to do the final signoff on the document. This included the Under Secretary, Assistant Secretaries for Housing, Community Planning and Development, Congressional Relations and the General Counsel. All finally agreed and the final abstract went to the Secretary in late May or early June of 1984. The document was not available to those outside HUD, but it was unofficially implied that the two basic points were to drop the testing requirement and to fund the second phase remediation demonstration program in Butte, for which HUD had claimed to have no money.[40]

About mid-June, when it was known that the Secretary had had the document for several weeks, a call was made to Deborah Dean, the Secretary's Executive Assistant. She said

she had put it in front of the Secretary who had delayed making a decision so she planned to have it brought up at one of the weekly meetings with the Assistant Secretaries when the Secretary was in attendance. Dean fully supported the decision and she thought that having the five key high officials who had signed off on it together at a meeting when it was considered would encourage the Secretary to sign it.

But the Presidential campaign was getting off the ground and very few policy decisions are made anywhere in government during an election. At this point, a decision to drop the testing requirement might be construed as anti-environmental. The Reagan Administration seemed sensitive to such issues in the 1984 election year. The decision abstract went back to the Under Secretary's office to wait out the election.

Right after the election, Brousseau reminded his boss of the issue. Shortly thereafter, the decision abstract with a reminder cover memo went from the Under Secretary back up to the Secretary.[41] Melcher's office also started making a series of calls to the Executive Secretariat's office and the office of Congressional Relations. The response was that the Secretary was very aware of the problem, and it was a "hot political issue."

HUD Decides

Finally, in July, 1985, Secretary Pierce replied to Senator Melcher -- more than a year and a half after the

Senator's strong request and more than a year after the Secretary had been presented with a carefully prepared decision abstract.

The decision was to rescind the testing requirement and to jointly announce, with EPA, a low-cost control technology demonstration project for 18 homes in Butte. Residents living in homes testing above risk level might finally have a solution to protect them from potential lung cancer risk. But, before that solution might be available, it could be close to ten years since Lloyd's initial Butte radon discovery.[42]

[1]Larry Lloyd, telephone interview, Washington, D.C.to Helena, Montana, 14 January 1985.

[2]Lloyd, Evaluation of Radon Sources and Phosphate Slag in Butte, Montana, p. 5.

[3]Ibid, p. 6.

[4]Ibid, p. 16.

[5]Ibid pp. 16 and 17.

[6]Ibid, pp. 17 and 18.

[7]Ibid, p. 24.

[8]Ibid, pp. 39, 43 and 46.

[9]"New Funds Doubtful for Radiation Studies," Montana Standard, 10 February, 1981.

[10]"Thermal Inversions Trap Radon Daughters in Butte," Montana Standard, 11 February 1981.

[11]"It's Low-Level funding vs. High-Level Radon," Montana Standard, 12 February, 1981.

[12]Ibid.

[13]"Silver Bow Homes a Radon Test Site, "Montana Standard, 17 March 1981.

[14]"Tests Started in Homes," Montana Standard, 24 June 1981.

[15]Lloyd, Evaluation of Radon Sources and Phosphate Slag in Butte, Montana, p. 43.

[16]Stephen E. Medves, Montana Air Pollution Study (Air Quality Bureau Environmental Sciences Division, Montana Department of Health and Environmental Sciences), June, 1981 p. ix.

[17]Ibid, pp. 100 and 102.

[18]Ibid, pp. 108-110.

[19]"New Devices Sought for Measuring Radon," Montana Standard, 14 August 1981.

[20]ARIX Planning and Design for a Radiation Reduction Demonstration Project (Report to State of Montana Department

of Health and Environmental Sciences) January, 1982 pp. i and ii.

[21]Ibid, p. 4-14.

[22]Ibid., p. 4-17.

[23]Larry Lloyd, Evaluation of ARIX Report Entitled "Planning and Design for a Radiation Reduction Demonstration Project" (Montana State Department of Health and Environmental Sciences), March 1981, pp. 5, 6, 7 and 10.

[24]Larry Lloyd, telephone interview, Washington, D.C. to Helena Montana, 14 January 1985.

[25]Larry Lloyd, Evaluation of Radon Sources and Phosphate Slag in Butte, Montana, p. 74.

[26]Donald R. Peoples, Butte-Silver Bow Chief Executive to Senator John Melcher, March 18, 1983.

[27]Senator John Melcher to HUD Secretary Samuel Pierce, Jr., May 5, 1984.

[28]"Quick End Sought for Radiation in Butte Homes," Montana Standard, 24 June 1983.

[29]Senator John Melcher to HUD Secretary Samuel Pierce, Jr., 18 January 1984.

[30]Chris Kafentzis, Manager, HUD District Office, telephone interview, Helena to Washington, D.C. 13 February 1985.

[31]Bill Burke, telephone interview, Washington, D.C. to Butte, Montana, 29 January 1985.

[32]Betty Kissock, telephone interview, Washington, D.C. to Butte, Montana, 30 January 1985.

[33]Interview with Pierre Brousseau, Washington, D.C., 11 December 1984.

[34]Ibid.

[35]Ibid.

[36]Ibid.

[37]Ibid.

[38]Ibid.

[39]Ibid.

[40]Ibid.

[41]Ibid.

[42]HUD Secretary Samuel Pierce, Jr., to Senator John Melcher, July 1985.

RADON IN AMERICA: THE LARGER CONTEXT

Butte and its unresolved indoor radon problem is, at this point, a dilemma within itself. But it also reflects larger questions that remain to be answered, broader national and international public policy implications that need to be addressed and solutions that should be available.

Radon Risk and Cigarette Smoking

First, what do we really know about the cancer risk from indoor radon daughter exposure? And what is the relationship, if any, of this exposure to cigarette smoking?

A May, 1984, report of the National Council on Radiation Protection and Measurements, NCRP, a nonprofit corporation chartered by Congress in 1964, extensively reviewed research with animals and uranium miners as related to radon exposure and the incidence of lung cancer. It concluded that "it is not definitely known if the extrapolation from the occupational experience to the general environmental situation is valid." But it concluded that it is "consistent with the present radiobiological concept that lung cancer induction is a stochastic process without threshold." Smoking, other environmental pollution and differences in the general population as compared to a small mining population also complicate the picture.[1]

A recent summary of research in animal studies suggested that effects of inhaled radon daughters were

similar to results found in human epidemiology. The major findings were:

1. Tumor production at very high exposures is much lower than at moderate exposures.
2. Preliminary evidence shows that long exposures at lower dose rates produces more lung tumors.
3. The effect of smoking upon radon daughter induced cancer is uncertain. One study showed a lower lifetime incidence of lung cancer in dogs exposed to cigarette smoking along with radon daughters rather than to radon daughters alone. It was tentatively ascribed to the increased mucus production from smoking. This effect was also found in Swedish miners.[2] Other studies have contradicted this finding.

An extensive study on lung cancer among U.S. uranium miners found "strong and consistent support for a description of lung cancer risk as the product of components due to radiation and to cigarette smoke. Smokers experienced a substantially higher radiation-induced risk." The data suggested that men who have smoked "twenty pack years" of cigarettes experience radiation-induced cancer rates that are roughly five times that of non-smokers. According to the study, this strong synergistic effect also prevails among cigarette smokers who are exposed to asbestos fibers.[3]

But whatever the relationship to cigarette smoking, the epidemiological data derived from many types of underground mining shows a consistent correlation between exposure to radon daughters and lung cancer incidence. These epidemiological studies of humans that have been exposed to short-lived daughters have been going on for over twenty years, and it will probably take another twenty years for a complete followup.[4]

As to the possible risk of increased public exposure in energy efficient homes with low ventilation or in other homes with elevated levels of radon daughters, this comprehensive NCRP study states there is "insufficient data to evaluate these exposure increases."[5]

A study by LeTourneau et al, 1983, concluded that studies in eighteen cities in Canada "could not detect a relationship between radon daughter concentrations and lung cancer mortality rates."[6] And a Peking research group reported on studies of 73,000 people in Guandong Province where for generations the population had been exposed to about double the normal amounts of radon because of monazite deposits with no adverse effects detected.[7]

But the general consensus seems to be that it is possible to estimate that an "arbitrary increase in the average exposure of the public might increase lung cancer rates."[8]

A June, 1984, headline in the New York Times read "Gas Emitted by Soil and Buildings Seen as a Cancer Source." It quoted an editorial in the New England Journal of Medicine as stating that "radon, a common radioactive gas emitted by soil, stones and most building materials, may be responsible for as many as 10,000 lung cancer deaths among nonsmokers in the United States each year."[9]

The editorial was written by Naomi H. Harley, Ph.D., Chairman of the Institute of Environmental Medicine at New York University Medical Center. She was also Chairman of the Task Group that prepared the previously cited 164 page report on "Evaluation of Occupational and Environmental Exposures to Radon and Radon Daughters in the United States" which also contained recommendations of the NCRP.

Two new studies related to the issue of smoking and lung cancer in miners were cited in the editorial. One study compared 32 Navajo men in New Mexico who had lung cancer with that of 64 controls who had died of nonpulmonary cancer. Twenty three of the lung cancer patients were uranium miners with median employment of thirteen years. Smoking is uncommon among Navajo Indians. Of the twenty three, information on cigarette smoking was available for twenty one. Eight were nonsmokers and median consumption by the others was one to three cigarettes daily. The miners with lung cancer were also an average of 20 years younger at death than were nonminers with lung cancer. The study concluded

that in a rural, nonsmoking population, most of the lung cancer may be attributable to one hazardous occupation, uranium mining.[10]

The other study investigated the effect of smoking on radiation induced cancer with Swedish miners. Fifty deaths were observed as compared with 12.8 expected. Among nonsmokers eighteen deaths were observed as compared with 1.8 expected. In this population with long follow-up, the study concluded that smoking did not have a "synergistic or multiplicative effect on the radiation induced cancer risk." The report indicated that the absolute risk of lung cancer induced by radon daughter exposure was only slightly higher for smokers than for nonsmokers.[11]

From these two studies, Harley concluded that "unless some threshold for the production of lung cancer exists, the risk of lung cancer does not stop at the exit from the mines and that about one fifth of lung cancer in nonsmokers is due to the normal lifetime exposure to radon with a lung cancer risk of fifteen cases per 1000 persons. On the basis of average values for environmental exposure and the lower estimate of risk, 10,000 people per year may die from lung cancer related to this source, she concluded."[12]

The implications for Butte from these latest studies are that indoor radon, indeed, may well be responsible for the high lung cancer death rate, in spite of the heavy

cigarette smoking of decedents found in the 1981 MAPS study. Clearly, more research specific to Butte would be helpful.

Exposure Risk Level Study

If we accept the assumption that there is increased lung cancer risk as a result of radon daughter exposure in the home, the next questions that arise concern acceptable risk levels, the extent of the problem and solutions to protect the public's health.

All exposure measurement has been based on the Working Level, or WL which is defined as "that concentration of radon daughters which has a potential alpha energy release of 1.3 x 10(5) MeV per liter of air."[13]

Because concerns continue to be raised about the potential exposure of the public to radon either from natural background or redistribution of radioactive materials such as from granite building products or reclaimed phosphate land, an in-depth study was done by a scientific committee of the NCRP.

Published in March, 1984, the report surveyed sources of radon, assessed levels of exposure, probable distribution and estimated risks. It concluded that information on levels and number of individuals exposed in the U.S. is incomplete. But the study specifies a level of exposure at which remedial measures should be taken and suggests a variety of remediation techniques.[14]

After extensive and comprehensive investigation and analysis of risk levels of various types of radiation exposure such as soil, external, inhalation, drinking water and dietary intake, the report recommended "that an excess risk of death from lung cancer of two percent or more over a lifetime for the individual exposed to elevated or enhanced levels of radon daughters should be avoided."[15] The specified risk level at which remedial action should be taken for radon daughter inhalation was an annual exposure of 2WLMy which can be translated to an average WL of 0.04, double the 0.02 WL risk level commonly used and now used in Butte.[16]

The report stated that radon daughter evaluations require "integrated or extended measurements covering a year under representative living conditions."[17] As for remediation, it found that cracks in the concrete basement walls or basement slabs were the most common source of radon diffusion into the home. These cracks could be microscopic and still be very effective."[18]

Indoor Air Pollution Awareness Grows

In the past five or six years, the radon and indoor air pollution risk potential throughout the country has been getting increased attention in the scientific and general print media. Concern has heightened as buildings have become more and more energy efficient and reports of high radon levels sift in from throughout the country.

The Wall Street Journal in 1979 quoted Jan Stolwijk, an epidemiologist and member of a World Health Organization committee, as saying that "There's probably more damage done to human health by indoor pollution than outdoor pollution." Until recently, indoor air pollution had not been considered a serious health hazard because, according to an architect quoted in the article, most homes, offices and public buildings "leaked like a sieve." Studies of air pollution inside energy efficient buildings are relatively new in the United States, even though by 1979, Sweden, Denmark and West Germany had already issued standards for certain pollutants and installed remediation measures.[19]

In early United States studies, a government researcher in Maryland found radon gas concentrations in a model energy efficient home ten times higher than in a more typical "leaky" house. In Texas, researchers measuring radon emitted from well water found radon gas in the bathroom well above a risk level. The Wall Street Journal article further reported that Charles Hess, a nuclear physicist at the University of Maine, believed that natural radiation is even more dangerous than the risks from the Three-Mile Island reactor because "people are exposed to it for a lifetime, not just a few days."[20]

In 1980, the New York Times, in an extensive feature story, focused on the radiation danger of radon seeping into homes from stone walls and soil. The article appeared near

the end of the environmentally activist Carter Administration and The Radiation Policy Council in the Executive Office of the President had asked the Environmental Protection Agency to prepare a strategy for determining more precisely "the extent of public exposure to radon and its health effects." Again, energy efficiency enhanced the awareness of radon risk. The article cited the finding that in homes where rock, especially granite, is used as a reservoir for solar heat, "air circulated through the rock to heat the house at night can become heavily laden with radon."[21]

The extensiveness of the problem throughout the United States continued to be unknown. A survey of nineteen cities in Canada led to an estimate that ten percent of homes there have excessive levels and some unacceptably high levels turned up in twenty-one homes in the metropolitan area of New York City. Grand Junction and Durango, Colorado built on top of or with uranium mill tailings and central Florida, where about 50,000 acres of land has been reclaimed from phosphate strip mining, are often cited as having high levels. Northern New England is another highly radioactive area where wells penetrate granite. Radon from the water there escapes into the air, especially when showers or washing machines are used.[22]

By 1981, the more general problem of indoor air pollution was getting attention from some individuals and organizations who were concerned with environmental hazards

and public health. the National Academy of Sciences, is a report prepared for the EPA, stated that indoor air pollution is a "serious and growing problem that can cause discomfort, illness and even death." Representative Toby Moffett, then Chairman of the House Energy and Natural Resources Subcommittee, said that action must be taken to protect the public from indoor air pollution. He wrote to Anne Gorsuch, Administrator of the EPA under the new Reagan Administration, complaining that the agency was planning to reduce research on indoor air pollution sharply and stating that "Since Americans spend ninety percent of their time indoors and scientists have already discovered over a dozen hazardous substances in ambient indoor air, EPA should instead be expanding its research effort."[23] EPA, under Gorsuch, appeared more concerned with budget slashing than protecting the public health and welfare. A year later, Toby Moffett was defeated in his bid to become U.S. Senator from Connecticut. As yet, no other strong spokesman on this issue has emerged in Congress.

Energy Efficiency Increases Risks

Some research did continue. Robert Fleischer of the General Electric Research and Development Center in Schenectady, New York, said in 1981 that his studies indicated that "the elevated levels found in a significant fraction of energy-efficient homes give exposures to radon that are equivalent to those that are directly known to

produce lung cancer in miners with no extrapolation to lower levels being required." In a survey of radon levels in 27 homes, 14 of which were considered "tight" or energy efficient, levels were much higher in the tight homes and shot up to more than four times the acceptable level in the winter, when the homes were closed up.[24]

For several years, there was less attention in the public press to the radon and indoor air pollution problem. In 1984, the Wall Street Journal published an article comparing the basement home office of a man in Schenectady, New York, to a uranium mine with 200 times the radon concentration of an average home. Radon from the soil around his water well entered his basement through a vent. It dropped sharply after he plugged up the vent.[25]

By this time, high radon levels had also been found in areas other than Butte, Colorado and Florida. Geological formations in eastern Pennsylvania, parts of New England and upstate New York all had above risk levels. The National Association of Home Builders recognized the problem of indoor air pollution, but allocated only $12,000 to its research foundation.[26]

In Sweden, many homes built over granite and shale have extremely high levels increased by energy tight construction for the cold climate. There, the government now sets maximum radon levels for new homes and gives loans and other assistance for remediation in older homes. But in the

United States, the EPA was still ducking. Although "of concern," there isn't enough information about risks and remedy costs to establish specific standards said Gordon Burley, science advisor to the EPA Office of Radiation Protection.[27]

One of the most significant and comprehensive articles on the overall issue of indoor air pollution appeared in the March, 1983 issue of the Environment magazine. The author, Laurence S. Kirsch, is on the advisory board of the National Indoor Environmental Institute and is an attorney with a background in science and environmental studies.[28]

Kirsch defines indoor air pollution as "pollution that is found in residential buildings at levels that affect human health." He agrees with the view that indoor air pollution may be an even greater health threat than outdoor air pollution. Health effects may be more severe as people spend most of their time indoors, therefore, exposures are more prolonged and frequent, he says.[29]

Although Kirsch goes into much detail about the extent, measurement and generally accepted health risk of radon, he cautions that "conclusions are at best sketchy, and those estimates based on the mine studies may be too pessimistic because radon progeny enter the lungs attached to dust particles, and dust levels are far lower in homes than in mines." But he does accept an EPA statement that radon exposure inside buildings may account for as many as ten

percent of all lung cancer deaths in the United States which means an "enormous health effect."[30] Kirsch also examined the risk of other indoor pollutants--"combustion products, formaldehyde, asbestos, chemical fumes and particles are all potentially dangerous with diverse health effects."[31]

On January 7, 1985, Newsweek magazine published an article titled "Sick-Building Syndrome" or "The Deadliest Pollutants of All May be the Ones You Breath at Home or at Work." Now, EPA researchers were quoted as finding that indoor pollution concentrations are two to five times higher than outside levels, sometimes over a hundred times higher. EPA environmental scientist, Lance Wallace, described it as "We're all living in a chemical soup." And Newsweek again raised the radon risk stating that the "clearest danger is posed by radon gas." By now, the extrapolations and assumptions have become familiar--that 2,000 to 20,000 cases of lung cancer each year may be caused solely by indoor radon pollution. Anthony Nero of Lawrence Berkely Laboratories, stated that "There are about a million homes with radon levels over the recommended standard. No other environmental risk, such as toxic waste dumps, affects that many homes."[32]

And then, on April 20, 1985, CBS evening news broadcast that the state of Pennsylvania was surveying for indoor radon levels 22,000 homes in the Reading Prong area of Eastern Pennsylvania which also extends into New Jersey and

New York State. Over half of the homes tested at that point were found to be above risk level.

A month later, on May 19, the front page of the Sunday New York Times carried a story with a two column headline, "Radioactive Gas in Soil Raises Concern in Three-State Area." The article stated that levels in "some houses were the highest ever recorded in the United States." Radon was seeping up from uranium deposits in the three-state geologic formation below. James Staples, spokesman of the New Jersey Department of Environmental Protection, described the situation as "an entirely new area of concern that nobody even guessed at six months ago." More than 100,000 people lived in the area. As in Butte, the high levels were discovered by accident. An engineer working on the construction of a nuclear power plant set off a radiation alarm when he entered the plant. His home was later tested and his living room showed 16 "working levels of radon."[33]

So if there is, indeed, possibly a critical threat in some areas, and larger, more pervasive damage to public health throughout the United States, not only regarding radon but indoor air pollution in general, what are the public policy implications? What has been done? What could be done? What should be done?

Options for Control

Some people feel that the individual's level of indoor air quality is his own choice and he should be allowed to

make his own decisions under free market mechanisms. Others view that federal, state and/or local regulation may be necessary for products that affect indoor air quality and still others think that the states and/or local governments should control indoor air quality.[34]

The federal government has shown a broadly based, but haphazard interest in the topic, with at least eleven different agencies involved to some extent at one time or another. But until recently, Congress hasn't given any specific direction to the federal government in either indoor air research or control.[35] As a result, the current statutory and common law mechanisms for dealing with indoor air pollution and its potential health risks are inadequate and uncertain; what programs there are "have been contradictory in some cases and redundant in others."[36]

Kirsch considers that federal agencies are not acting on indoor air pollution for the following reasons:

1. Regulators have lacked extensive scientific information on which to base their actions.
2. Some regulators fear that recognition of an indoor air pollution problem would increase pressure to weaken outdoor air quality standards.
3. Regulators are reluctant to intrude into private homes.

4. Regulators have not shown great concern because they have not been subject to public pressure to regulate indoor pollution.
5. Most importantly, regulators have been reluctant to act without unequivocal statutory authority.[37]

The major federal laws that might be used to regulate indoor air pollution are the Clean Air Act, the Toxic Substances Control Act and the Comsumer Product Safety Act. There are also other federal statutes and state and local laws that could be used. The Clean Air Act seems to be the most obvious law for controlling indoor air pollution. Its mandate is broad enough in that it gives the EPA authority to regulate air pollution in the ambient air so as "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Congress appears not to have considered the question and therefore did not specifically include or exclude indoor air when the Act was passed in 1970 or amended in 1977.[38]

However, EPA has defined its authority as specifically regulating only outdoor air quality. Administrator Anne Gorsuch had even stated that EPA did not have the legal authority to do research on indoor air pollution. There is one section of the Act that EPA has used for authoritative action in controlling one indoor pollutant. This is Section 112 which permits swift regulation for especially dangerous

pollutants and EPA has used it to stop spraying of asbestos insulation and decorative products inside buildings.[39]

More specific to radon, the NCRP concludes that there is "no current legislation that provides any particularly useful guidance with respect to a workable approach to the regulation of radon concentrations in inhabited structures."[40]

Besides direct regulation, other forms of government intervention could include education, common law liability, voluntary standards and research. Research is probably the "least intrusive" form of government action and the lack of insufficient information about the extent, risks and effective control measures of indoor air pollution is an obstacle to solving the problem of protecting the public health.[41]

[1]National Council on Radiation Protection and Measurements. Evaluation of Occupational and Environmental Exposures to Radon and Radon Daughters in the United States, 31 May 1984, p. iii.

[2]Ibid, pp. 3 and 4.

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[15]Ibid, p. 88.

[16]Ibid, p. 89.

[17]Ibid, p. 91.

[18]Ibid, p. 33.

[19]"Indoor Air Pollution Worries Experts as Buildings are Sealed to Save Fuel," Wall Street Journal, 15 August, 1979.

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[35]Ibid, p. 11.

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[41]Laurence S. Kirsch, "Behind Closed Doors, Indoor Air Pollution and Government Policy." Environment, April 1983, p. 35.

CONGRESSIONAL, ADMINISTRATION, AGENCY ACTION/INACTION

In 1981 and 1982, a small indoor air research effort was funded by EPA. Congress passed specific funding legislation for indoor air research and development by EPA in the 97th Congress but the entire bill was vetoed by President Reagan for other reasons. However, another two million dollars for indoor air research for 1984 was added by Congress. On July 12, 1984, the President signed the HUD and Independent Agencies Appropriations Act of 1984 which again included two million dollars for indoor air research in 1985 and set up a federal Committee on Indoor Air Quality co-chaired by EPA, the Department of Energy and the Consumer Products Safety Commission.[1]

The Interagency Committee on Indoor Air Quality has a Radon Working Group with representatives from five agencies. It has issued a draft report and is identifying priorities for research needs and for policy-making activities.[2] In March of 1984, the NCRP recommended that, without delay, a preliminary range-finding survey be taken of 1,000 homes within 10 of the largest, geographically distributed Standard Metropolitan Statistical Districts. The results would indicate whether a larger scale program would be necessary to further assess the extent of radon throughout the country.[3] The Interagency Committee has noted this recommendation and given it particular importance. But the Committee recommends

a national assessment of representative U.S. structures, appropriately distributed in terms of climate and geology to identify those areas and conditions where high indoor radon exposures are likely."[4]

In planning for the federal fiscal year 1986, the Office of Radiation Programs of EPA developed a five year Radon Assessment and Control Program proposal with a four and half million dollar cost. The plan was circulated in October by the conference of Radiation Control Program Directors to its state members around the country for review and comment. The goal of the program was to "have an understanding of the distribution and levels of radon throughout the United States and the means available to prevent or ameliorate high levels of radon." One of the major information needs cited is the frequency distribution of individual exposure in "normal" settings as this "could represent the greatest exposure to the public.[5]

However, the 1986-1990 five year plan did not successfully make it through the EPA agency budget process for 1986. Another $2 million to continue the indoor air research and demonstration program was retained in the agency budget but eliminated by the Office of Management and Budget (OMB).[6]

Officially, EPA has paid scant attention to radon in recent years. In 1981, OMB forced the Office of Radiation Programs to eliminate 27 positions and stifled work on radon.

EPA appealed to OMB, citing the potential lung cancer risk estimate of up to 20,000 radon-caused deaths per year, but the edict remained. Since then, EPA staff who are concerned and want to work on the radon problem have "become beggars."[7]

OMB continues to oppose further federal government involvement with indoor air research or regulation. Probable reasons cited by EPA officials are the fear of getting into another federal regulatory program; apprehension that research will reveal serious, widespread health risks and, most obviously, budget constraints.[8] In report language, the Congress and Appropriations committee asked that EPA, in conjunction with CIAQ, prepare and submit a strategy document to Congress by January 1, 1985. It was submitted in December, 1984, but did not clear OMB until late spring.[9]

Lloyd Criticizes

Larry Lloyd was highly critical of certain aspects of the five year plan. He accused the Office of Radiation Program of "reinventing the wheel."[10] In a letter to Chuck Hardin, Executive Secretary of the Conference of Radiation Control Program Directors, Lloyd said the overall program had merit, but there was little thought in coordinating its research with "other agencies that have already conducted a substantial amount of the work proposed by EPA." Lloyd also strongly criticized the proposal objective cited as "Development of measurement protocols using existing instruments," since that was the purpose of the Butte study

and, according to Lloyd, EPA had not followed up with assembling and assessing the data and issuing a report as provided for in the contract. But Lloyd was most incensed that EPA was not moving on research "to demonstrate effective, low-cost preventative and remedial techniques for the reduction of radon concentrations in structures." He strongly felt that "we should have solutions in hand before looking for more problems."[11]

On January 18, 1985, Lloyd came out with a blast in the Montana Standard saying he planned "to continue pushing for funding to rid homes in Butte of deadly radon gas." Lloyd said he planned to push for the remedial demonstration program at the winter business meeting of the Conference of Radiation Control Directors in February and with Montana's Congressional delegation. Although he supports a national radon survey, Lloyd argued that, "We must conduct remediation demonstrations before we go out and find more problems. We don't want to find more problems unless we have some solutions to them."[12]

Jim Christopulos, HUD's representative to the Radon Interagency Radon Working Group, is of the same strong opinion. He, too, believes a national assessment is necessary. But, even more, after 41 years at HUD, he says he is not going to leave until he sees two things through. One is completion of a remediation demonstration for new construction in Florida and the other is getting a

remediation demonstration program off the ground for existing housing in Butte and the high radiation area of Pennsylvania.[13]

Mitigation Project Beginning

As a result of the $2 million appropriated by Congress for indoor air research for federal fiscal year 1985, EPA has begun the first stage of a low-cost radon mitigation project. It is a three-year, $600,000 project and will be dependent upon additional appropriations by Congress. The objective is to demonstrate low-cost retrofit and new construction techniques that will be used to provide guidance primarily to builders, building code officials and homeowners/occupants. The effectiveness of these techniques would be demonstrated in a series of field programs which would be installed and performance-tested in representative numbers and types of new and existing homes. "Low-cost" would be an installed cost to a homeowner less than two percent of the market value of his house plus low cost operation and maintenance.[14]

The program plan for the project is nearing the end of the first draft stage. The Project Officer, John Ruppersberger, envisions the first site project will be underway by summer or early fall of 1985. This will be in the Reading Prong area of Eastern Pennsylvania where indoor radon levels have been tested up to 0.23 WL. This project is planned for eighteen demonstration units.[15]

According to Ruppersberger, Butte and the Reading Prong area will share the second stage project, each with eighteen demonstration units.[16]

Differences in the attitudes toward and expertise with indoor radon within EPA is reflected in the administration of this project. Ruppersberger appears to be very concerned about the problem and committed to the project. He works for the Research and Development Division of EPA which, according to Richard Guimond, Director of the Criteria and Standards Division of the Office of Radiation Programs, may not have the interest or technical know how for radon research, yet is charged with the responsibility for the program. An informal working relationship seems to be in place between Ruppersberger, Guimond and Tim Krowe, Guimond's Deputy, as the Office of Radiation has the technical expertise to give the project more effective but unofficial direction.[17]

Also, there are ways that EPA bureaucrats who are deeply concerned about the public health risks of radon can work in indirect and roundabout means towards their goals. Inquiries from Congressional staff can provide information, other resources and expand the network of other interested members and staff on the Hill. For instance, the five year national assessment and control plan which was circulated to state radiation control officers was an internal document which cannot be sent directly to Hill staff, but may reach

them indirectly through state-Congressional contact - or just appear in their mail.

Dave Berg, former Director for Indoor Air within the Research and Development Office of EPA, strongly believes that total exposure studies should be done with individuals in an indoor radon environment. This could also be incorporated into authorization legislation and Berg has made himself unofficially available for technical assistance.[18]

Future Solutions?

But research alone won't solve the problem. More precise data on the extent and targeting of the problem, the exposure levels, epidemiology and control technology is essential, but only the beginning. Kirsch recommends that EPA translate the results of standards to guide individuals, state and local governments and the federal government itself. These standards could be used by homeowners themselves, for building codes or product standards.

Congress could act further and set up a regulatory framework to deal with indoor air pollution if and when necessary. The Clean Air Act, which is up for reauthorization this year, could be amended to more specifically cover indoor air. Or a separate statute, structured like the Clean Air Act, might be enacted. This makes the federal government responsible for research and developing standards, but holds the states responsible for meeting those standards. If future research reveals more

critical health risks, Congress could set and regulate mandatory federal standards which, however, many might find intrusive and objectionable.

But any of these potential solutions are far in the future. Considering the current Congressional preoccupation with the budget and the federal deficit, coupled with a lack of support from the Administration, simply continuing the $42 million appropriation for indoor air research for federal fiscal year 1986 might be a real victory.

In May of 1985, legislation for a modest indoor air program was being developed for introduction in the U.S. Senate as a companion bill to one that had been introduced in the House of Representatives in April. Senator George Mitchell of Maine had been sensitized to the radon risk by his constituents and he was the prime mover. The Senate bill would definitively give EPA authority to conduct a research program on indoor air quality, would require a report to Congress within two years summarizing what was known about the problem, identify needed research and potential actions needed to mitigate health effects. $3 million would be authorized for the research program, only $1 million more than the modest amount appropriated the past two years.

This bill was still in the discussion stage when the New York Times broke the front page story on the Reading Prong on Sunday, May 19. Senator Mitchell wanted to take advantage of this publicity edge and the bill was quickly

introduced on May 23. Other original cosponsors of the bill were Robert Stafford of Vermont, Chairman of the Committee on Public Works and Environment that had jurisdiction over the bill, and Senator Frank Lautenberg of New Jersey, also a member of the Committee as was Senator Mitchell.[19]

The next day, on May 24, the New York Times followed up with, not an emphasis on the introduced legislation, but on the EPA "inside document" proposal to initiate a major Federal effort to locate areas throughout the country where radon may cause risks to public health. Dr. H. Ward Alter, president of a company in California that measures buildings for radon contamination, was quoted as saying the problem was widespread. Introduction of the legislation was cited toward the end of the article saying it would give the federal government authority and funds to do research into the hazards of radon and other indoor air pollution. But this story concluded quoting the EPA draft proposal that high concentrations of radium "May, in fact, occur in any structure in the United States."[20]

Whether it be in Butte, the Reading Prong or wherever else in America, the medical and human costs of possibly up to 20,000 lung cancer deaths a year from an invisible, odorless gas in homes, is a public health policy challenge that should no longer be ignored. Will Congress face up to that challenge?

[1]Michael Simpson, Indoor Air Quality and Health Impacts of Energy Conservation, Congressional Research Service, 3 January 1985, p. 11.

[2]"Report of the CIAQ Radon Working Group" (draft) June, 1984 (photocopied).

[3]National Council on Radiation Protection and Measurements. Exposures from the Uranium Series with Emphasis on Radon and its Daughters, 15 March, 1984, p. 92.

[4]"Report of the CIAQ Radon Working Group," June, 1984, (photocopied).

[5]"Radon Assessment and Control Program EPA", Fall, 1984, p. 5 (photocopied).

[6]David Berg, Former Director, Indoor Air, EPA, interview, Washington, D.C., 3 March 1985.

[7]Ibid.

[8]Ibid.

[9]Administrator's Briefing, Indoor Air TEAM, Love Canal Agenda, Internal EPA document, 12 March 1985 (photocopied).

[10]Larry Lloyd, telephone interview, Washington, D.C. to Helena, MT, 14 January 1985.

[11]Larry Lloyd, chief, Occupational Health Bureau, Montana Department of Health and Environmental Sciences to Chuck Hardin, Executive Secretary, Conference of Radiation Control Directors, Inc., October 22, 1984.

[12]"Butte's Radon Problems Not Forgotten," Montana Standard, 18 January, 1985.

[13]Jim Christopulos, Washington, D.C. interview, 24 January, 1985.

[14]John Ruppensberger, EPA Project Control Officer, telephone interview, Washington, D.C. to Triangle Park, North Carolina interview, 2 February 1985.

[15]Ibid.

[16]Ibid.

[17]Richard Guimond, Director, Criteria and Standards Division, Office of Radiation Programs, EPA, interview, 4 March 1985.

[18]David Berg, interview, 3 March 1985.

[19]"Radioactive Gas in Soil Raises Concern in Three-State Area," New York Times, 24 May 1985.

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